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Collective dynamics of sperm in viscoelastic fluid[1] CHIH-KUAN TUNG, [1,2], BENEDICT B. HARVEY, [2], ALYSSA G. FIORE, [1], FLORENCIA ARDON, SUSAN S. SUAREZ, [2], MINGMING WU, Depts of [1]Biological and Environmental Engineering; [2]Biomedical Sciences, Cornell University — Collective dynamics in biology is an interesting subject for physicists, in part because of its close relations to emergent behaviors in condensed matter, such as phase separation and criticality. However, the emergence of order is often less drastic in systems composed of the living cells, sometimes due to the natural variability among individual organisms. Here, using bull sperm as a model system, we demonstrate that the cells migrate collectively in viscoelastic fluids, exhibiting behavior similar to flocking. This collectiveness is greatly reduced in similarly viscous Newtonian fluids, suggesting that the cell-cell interaction is primarily a result of the elastic property or the memory effect of the fluids, instead of pure hydrodynamic interactions. Unlike bacterial swarming, this collectiveness does not require a change in phenotype of the cells; therefore, it is a better model system for physicists.

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